

Research Note

The prevalence of intestinal parasitic infections among Kosovar and Serbian school-children in Kosovo

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Summary

The aim of this study was to estimate the prevalence and distribution of species of intestinal parasites in the Balkans on the example of Kosovar and Serbian residents from the region of Gnjilane in eastern Kosovo, where the epidemiology of intestinal parasitic infections remains unknown. Parasitological examination of stool specimens was performed in 2017 and 2018. Stool samples were collected from asymptomatic school-children aged 6 – 17 years: 530 Kosovars from the municipality of Kaçanik and 310 Serbs from the municipalities of Kamenica and Strpce. Each patient provided two stool samples collected every second day, fixed in SAF preservative and 70 % spiritus vini, transported to the Department of Epidemiology and Tropical Medicine at the Military Institute of Medicine in Poland, and tested by light microscopy using three diagnostic methods: direct smear in Lugol's solution, decantation in distilled water, and Fülleborn's flotation. A total of 101 Kosovar children (19.1 % of the study group) were found to be infected with intestinal parasites: nematodes (n=20), cestodes (n=2), trematodes (n=2), and protozoa (n=79). Only 13 Serbian children (4.2 %) were found to be infected with nematodes (n=4), cestodes (n=3), and protozoa (n=6). *Giardia intestinalis* was the most prevalent intestinal parasite in both groups (14,9 % vs. 1.9 % children). The prevalence of asymptomatic parasitic infections was significantly higher in Kosovars in comparison to the Serbs living in the same region of eastern Kosovo. This fact shows that there may be significant differences in the quality of health care and sanitation as well as food hygiene between these two communities. **Keywords:** helminths; protozoa; children; epidemiology; Kosovo

Introduction

Despite a spectacular advance in the diagnosis and management of diseases, intestinal parasitic infections remain a major public health issue globally (Keiser and Utzinger, 2010). It is estimated that more than two billion people worldwide are infected with at least one species of intestinal parasite and over five billion people live in countries where helminths and protozoa are endemic (Kucik *et al.*, 2004). The risk of infection is particularly high in areas with poor sanitation because poor hygiene and the lack of adequate

sanitation facilities encourage the spread of food and waterborne diseases (Hotez *et al.*, 2007). There are a number of factors which facilitate the spread of parasitic infections both in the developing and the industrialized world; these include low socioeconomic status, mass migrations, and the presence of hosts in ecosystems (reservoirs of parasites) (Ali *et al.*, 2014; Ojha *et al.*, 2014). The spectrum of clinical symptoms in parasitic infections is extremely wide and may vary from asymptomatic cases through diarrhea to cachexia leading to severe anemia (Korzeniewski and Kurpas, 2016). Microscopic examination is still the gold standard for the

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diagnosis of intestinal helminths and protozoa making it possible to detect parasites at their different developmental stages (cysts, trophozoites, larvae, ova) (Myjak *et al.*, 2011). In Europe, high rates of parasitic infections are reported from the countries which are listed in the third and fourth quartile according to gross domestic product per capita (GDP \$1 809 – \$17 630) (Hotez and Gurwith, 2011); Kosovo ranks in the 4<sup>th</sup> quartile. The exact prevalence of parasitic infections in Kosovo is not clear because the country lacks organized epidemiological screening. In 2001, a study was conducted to establish the etiology of diarrhea in 45 Kosovar children (Kosovska Mitrovica). It revealed that 40 % of the diarrhea cases in the study group were associated with *Giardia intestinalis* (Quamilè *et al.*, 2011). Another study aimed at assessing the prevalence of parasitic infections in Kosovo was conducted by the authors of the present article in 2015. The study group consisted of 632 Kosovars (children and adults) living in the municipality of Kaçanik located in southern Kosovo. We found that 12 % of the study population had asymptomatic parasitic infections, mainly *Giardia intestinalis* infection (10 % of the infected individuals) (Korzeniewski and Augustynowicz, 2017). Kosovo has a population of around 2 million people. The majority of its residents are Albanian, but there are also some significant ethnic minorities living in the country, of which the Serbian minority is the largest (140,000). The aim of this study was to assess the prevalence and distribution of species of intestinal parasites in the Balkans on the example of Kosovar and Serbian residents from the region of Gnjilane in eastern Kosovo, where the epidemiology of intestinal parasitic infections remains unknown.

## Material and Methods

### Study population

In total, 840 asymptomatic school-children, aged 6 – 17 years,

living in the region of Gnjilane in eastern Kosovo (including 530 Kosovars from the municipality of Kaçanik and 310 Serbs from the municipalities of Kamenica and Strpce) were screened for intestinal parasites in 2017 and 2018. The approval to perform the study involving Kosovar children had been given by the Head of Medical Service and Social Health Department Mrs. Diana Reka and the Head of Education and Culture Department Mr. Enver Kamishi and issued in the Kaçanik municipality. The approval to perform a research study among Serbian children had been obtained from the Director of Medical Center for the Gnjilane region, Dr. Zoran Perić. Written informed consent was provided by parents or legal guardians of the children involved in the study (handwritten signatures on a collective list of all study participants). The details of the study were explained to the participants in patient information brochures written in the Albanian and Serbian languages.

### Sample collection and laboratory procedures

Each patient provided two stool samples collected every second day at Kosovar and Serbian healthcare facilities and local schools. The specimens were fixed in SAF (sodium-acetate-acetic acid-formalin) preservative and 70 % spiritus vini, transported to the Department of Epidemiology and Tropical Medicine at the Military Institute of Medicine in Poland, and tested by light microscopy using three diagnostic methods: direct smear in Lugol's solution, decantation with distilled water, and Fülleborn's flotation (Clinical and Laboratory Standards Institute, 2005; Garcia *et al.*, 2003; WHO, 1991).

### Statistical analysis

The statistical analyses have been performed using the statistical suite StatSoft Inc. (2014) STATISTICA (data analysis software system) version 12.0. [www.statsoft.com](http://www.statsoft.com) and Excel. The quantitative variables were characterized by the arithmetic mean of standard deviation or median or max/min (range). The qualitative variables

Table 1. Intestinal parasitic infections among 530 Kosovar school-children residing in Gnjilane region (Kaçanik municipality).

Intestinal parasites	No of infections (n=103)	% of infections	% of examined patients (n=530)
<b>Nematodes</b>	<b>20</b>	<b>19.5</b>	<b>3.8</b>
<i>Ascaris lumbricoides</i>	8	7.8	1.5
hookworm	8	7.8	1.5
<i>Trichuris trichiura</i>	3	2.9	0.6
<i>Enterobius vermicularis</i>	1	1.0	0.2
<b>Cestodes</b>	<b>2</b>	<b>1.9</b>	<b>0.4</b>
<i>Hymenolepis nana</i>	2	1.9	0.4
<b>Trematodes</b>	<b>2</b>	<b>1.9</b>	<b>0.4</b>
<i>Dicrocoelium dendriticum</i>	2	1.9	0.4
<b>Protozoa</b>	<b>79</b>	<b>76.7</b>	<b>14.9</b>
<i>Giardia intestinalis</i>	79	76.7	14.9
<b>No of infected</b>	<b>101</b>	<b>100.0</b>	<b>19.1</b>

were presented with the use of count and percentage. A statistical significance level of 0.05 was used for all calculations.

### Ethical Approval and/or Informed Consent

The research project was approved by the Bioethics Committee at the Military Institute of Medicine in Poland (Decision No. 72/ WIM/2017) under the Declaration of Helsinki and in line with the EU provisions on *Good Clinical Practice for conducting clinical trials and testing medicinal products* signed by the Polish Bioethics Committee.

### Results

Following the microscopic examination of 1,680 stool specimens (two samples taken from each of the 840 subjects) by three different light microscopy methods we found that the total prevalence of intestinal parasites was 19.1 % in Kosovar (n=530) and 4.2 % in Serbian school-children (n=310). The study revealed that 101 Kosovar children were infected with pathogenic intestinal parasites; a total of 103 infections were detected (two cases of co-infections). The most frequently detected intestinal parasites included *Giardia intestinalis* (14.9 % study subjects), *Ascaris lumbricoides* (1.5 %) and hookworm (1.5 %) (Table 1).

A total of 13 Serbian children were found to be infected with intestinal parasites. *Giardia intestinalis* (1.9 % of the study group) and *Ascaris lumbricoides* (1.0 %) were predominant (Table 2). Infections with non-pathogenic intestinal parasites, e.g. *Enatmoeba coli*, *Endolimax nana*, *Chilomastix mesnili* (found in both examined groups) were not taken into consideration and are not discussed in this paper.

### Discussion

Current epidemiological situation of intestinal parasitic infections (IPI) in Kosovo is unknown and presented study remains one of

few analyses in the field of intestinal parasitology in this region. Population screening to assess the prevalence of intestinal parasites have been carried out in the neighboring countries, e.g. in Albania and Serbia. The study of Sejdini *et al.* (2011) involving 321 children (aged 7 – 16 years) living in the counties of Tirana and Elbasan in central Albania demonstrated the overall IPI incidence of 19.0 %, the most prevalent being *Giardia intestinalis* (10.9 %), hookworm (5.6 %), and *Ascaris lumbricoides* (1.9 %). A different screening study performed by Spinelli *et al.* (2006) in 277 asymptomatic subjects from central Albania found that 24.2 % of the study group were infected with pathogenic protozoa and helminths, including *Trichuris trichiura* (12.3 %), *Giardia intestinalis* (11.2 %), *Hymenolepis nana* (1.8 %) and *Ascaris lumbricoides* (1.1 %). The authors' study involving 530 asymptomatic Kosovar school-children from the Gnjilane region demonstrated a similar overall incidence of IPI (19.1 %), where the most commonly identified parasites included *Giardia intestinalis* (14.9 %), hookworm (1.5 %) and *Ascaris lumbricoides* (1.5 %).

According to the research studies conducted in Serbia, the rates of infections with intestinal parasites in the local population are relatively low. A multicenter screening of 6,645 asymptomatic school-children, aged 7 – 11 years, from 115 settlements in 20 different regions of central Serbia (including Belgrade, Kragujevac, Lučani, Bor, Žagubica, Sjenica, Novi Pazar, Valjevo, Aleksandrovac, Piroć, Bosilegrad, Ivanjica, Golubac, Užice, Kladovo, Negotin, Kraljevo, Gornji Milanovac, Kruševac, and Čačak) found the overall prevalence of *Giardia intestinalis* infections to be 6.1 %. (Nikolić *et al.*, 2011). The authors' study conducted in the period between 2017 and 2018 among 310 asymptomatic Serbian school-children from the Gnjilane region in eastern Kosovo, demonstrated the overall incidence of IPI at 4.2 %, with *Giardia intestinalis* (1.9 %) and *Ascaris lumbricoides* (1.0 %) being predominant. Examination of 2,440 Serbian travelers returning from tropical and subtropical destinations revealed infections with intestinal parasites in 1.2 % patients only, mainly *Entamoeba histolytica* sensu lato and *Giardia intestinalis* (Dakić *et al.*, 2011). In recent years,

Table 2. Intestinal parasitic infections among 310 Serbian school-children residing Gnjilane region (Kamenica and Strpce municipality).

Intestinal parasites	No of infections (n=13)	% of infections	% of examined patients (n=310)
<b>Nematodes</b>	<b>4</b>	<b>30.8</b>	<b>1.3</b>
<i>Ascaris lumbricoides</i>	3	23.1	1.0
<i>Enterobius vermicularis</i>	1	7.7	0.3
<b>Cestodes</b>	<b>3</b>	<b>23.1</b>	<b>1.0</b>
<i>Hymenolepis nana</i>	2	15.4	0.7
<i>Diphyllobothrium latum</i>	1	7.7	0.3
<b>Protozoa</b>	<b>6</b>	<b>46.1</b>	<b>1.9</b>
<i>Giardia intestinalis</i>	6	46.1	1.9
<b>No of infected</b>	<b>13</b>	<b>100.0</b>	<b>4.2</b>

a majority of studies into the prevalence of intestinal parasites in humans that are carried out in Europe are primarily focused on the incidence of *Cryptosporidium* spp. and *Giardia* spp. Serbia is one of the countries participating in IPI surveillance (the number of reported giardiasis cases in the country fell from 4.6/100,000 in 2005 to 1.1/ 100,000 in 2014) (Plutzer *et al.*, 2018). Unfortunately, there is no reliable data available as to the prevalence of intestinal parasitic infections in Kosovo.

## Conclusion

Current epidemiology of intestinal parasites in Kosovo is unknown. The study involved asymptomatic Kosovar and Serbian school-children living in the same ecosystem of the Gnjilane region (eastern Kosovo) and demonstrated that the prevalence of intestinal parasitic infections in Kosovars is significantly higher in comparison to Serbian children, which may be the evidence of some differences in the quality of health care and sanitation as well as feed hygiene between these two communities.

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## Declaration of interest

The authors declare that they have no conflict of interest.

## References

- ALI, A.M., MASUD, T., ARIF, S. (2014): Frequency of parasitic infestation in faecal specimens. *J. Ayub. Med. Coll. Abbottabad*, 26(1): 49 – 51
- CLINICAL AND LABORATORY STANDARDS INSTITUTE (2005): Procedures for the Recovery and Identification of Parasites from the Intestinal Tract: Approved Guideline, M28-2A. Villanova, USA
- DAKIĆ, Z., NIKOLIĆ, A., LAVADINOVIĆ, L., PELEMIŠ, M., KLUN, I., DULOVIĆ, O., MILOSEVIĆ, B., STEFANOVIĆ, G., OFORI-BELIĆ, I., POLUGA, J., DJURKOVIĆ-DJAKOVIĆ, O., PAVLOVIĆ, M. (2011): Imported parasitic infections in Serbia. *Eur. J. Microbiol. Immunol.*, 1(1): 80 – 85. DOI: 10.1556/EuJMI.1.2011.1.10
- GARCIA, L.S., SMITH, J.W., FRITSCH, T.R. (2003): Selection and use of laboratory procedures for diagnosis of parasitic infections of the gastrointestinal tract. ASM press: Washington DC, USA
- HOTEZ, P.J., GURWITH, M. (2011): Europe's neglected infections of poverty. *Int. J. Infect. Dis.*, 15(9): e611 – e619. DOI: 10.1016/j.ijid.2011.05.006
- HOTEZ, P.J., MOLYNEUX, D.H., FENWICK, A., KUMARESAN, J., SACHS, S.E., SACHS, J.D., SAVIOLO, L. (2007): Control of neglected tropical diseases. *N. Engl. J. Med.*, 2007; 357(10): 1018 – 1027. DOI: 10.1056/NEJMra064142
- KEISER, J., UTZINGER, J. (2010): The drugs we have and the drugs we need against major helminths infections. *Adv. Parasitol.*, 73: 197 – 230. DOI: 10.1016/S0065-308X(10)73008-6
- KORZENIEWSKI, K., AUGUSTYNOWICZ, A. (2017): Parasitological examination among local residents in Afghanistan, Central African Republic and Kosovo conducted by the Polish military health service. *Int. Rev. Armed Forces Med. Serv.*, 90(2): 60 – 68
- KORZENIEWSKI, K., KURPAS, D. Diagnostics and treatment of parasitic diseases of the gastrointestinal tract. *Therapy*, 2: 56 – 66 (In Polish)
- KUCIK, C.J., MARTIN G.L., SORTOR B.V. (2004): Common intestinal parasites. *Am. Fam. Physician*, 69(5): 1161 – 1168
- MYJAK, P., GŁOWNIAK, C., GOŁĄB, E., JABOROWSKA-JARMOLUK, M., KOSIK-BOGACKA, D., MATOWICKA-KARNA, J., NOWAK, P., PIETKIEWICZ, H., SZOSTAKOWSKA, B., WNUKOWSKA, N., ŻARNOWSKA-PRYMEK, H. (2011): Standards in the range of laboratory activities in medical parasitology, estimation of their quality and diagnostics value, as well as interpretation and authorization of the tests results (proposals). *Journal of Laboratory Diagnostics*, 47: 341 – 351 (In Polish)
- NIKOLIĆ, A., KLUN, I., BOBIĆ, B., IVOVIĆ, V., VUJANIĆ, M., ŽIVKOVIĆ, T., DJURKOVIĆ-DJAKOVIĆ, O. (2011): Human giardiasis in Serbia: asymptomatic vs symptomatic infection. *Parasite*, 18: 197 – 201. DOI: 10.1051/parasite/2011182197
- OJHA, S.C., JAIDE, C., JINAWATH, N., ROTJANAPAN, P., BARAL, P. (2014): Geohelminths: public health significance. *J. Infect. Dev. Ctries*, 8(1): 5 – 16. DOI: 10.3855/jidc.3183
- PLUTZER, J., LASSEN, B., JOKELAINEN, P., DJURKOVIĆ-DJAKOVIĆ, O., KUCSERA, I., DORBEB-KOLIN, E. (2018): Review of *Cryptosporidium* and *Giardia* in the eastern part of Europe, 2016. *Euro Surveill*. 23(4): pii=16-00825. DOI: 10.2807/1560-7917.ES.2018.23.4.16-00825
- QUAMILÈ, I., ROGERIE, F., GRANDADAM, M., TEYSSOU, R., NICAND, E., KOECK, L., FEJZIA, I., BUISSON, Y., REY, J.L. (2010): Survey of diarrhoea survey in Kosovo Mitrovica. August 2001. *Sante*, 20(1): 9 – 14. DOI: 10.1684/san.2009.0176 (In French)
- SEJDINI, A., MAHMUD, R., LIM, Y.A., MAHDY, M., SEJDINI, F., GJONI, V., XHAFERRAJ, K., KASMI, G. (2011): Intestinal parasitic infections among children in central Albania. *Ann. Trop. Med. Parasitol.*, 105(3): 241 – 250. DOI: 10.1179/136485911X12987676649584
- SPINELLI, R., BRANDONISIO, O., SERIO, G., TREROTOLI, P., GHEZZANI, F., CARITO, V., DAJCI, N., DOCI, A., PICAKU, F., DENTICO, P. (2006): Intestinal parasites in healthy subjects in Albania. *Eur. J. Epidemiol.*, 21: 161 – 166. DOI: 10.1007/s10654-005-5926-3
- WORLD HEALTH ORGANIZATION (1991): Basic laboratory methods in medical parasitology. Geneva, Switzerland
- YOUNAS, M., SHAH, S., TALAAT, A. (2008): Frequency of *Giardia lamblia* infection in children with recurrent abdominal pain. *J. Pak. Med. Assoc.*, 58: 171 – 174